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EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT PAPER NUMBER

1765

DATE MAILED: 08/29/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/943,196

Applicant(s)

MAY, CHARLES E.

Examiner

Lynette T. Umez-Eronini

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 18-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8, 12 and 14 is/are rejected.
- 7) ☐ Claim(s) 9-11, 13 and 15-17 is/are objected to.
- 8) ☒ Claim(s) 18-20 are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Declaration*

1. The Declaration filed on August 6, 2003 under 37 CFR 1.131 is sufficient to overcome the Ri (JP 20001139935-A) reference. However, the declaration fails to overcome the new art rejection that follows.

### *Claim Rejections – 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 2, 3 and 12 are rejected under 35 U.S.C. 102(a) as being anticipated by Farkas et al. (US 6,001,730).

Farkas teaches, "The present invention relates generally to semiconductor manufacturing, . . ." (column 1, lines 7-10). "**FIG. 1** illustrates a semiconductor structure **10** which has a substrate **12**" (column 3, lines 51-52). **FIG. 3** illustrates that the structure **10** of **FIG. 1** is placed into a chemical mechanical processing (CMP) tool" (column 5, lines 24-25). "The copper layer **22** of **FIG. 1** is placed into contact with a chemical mechanical polishing (CMP) slurry **24** as illustrated in **FIG. 3**. The . . . polishing pad **26** in the CMP tool is placed in contact with the slurry **24** and is mechanically rotated and applied with pressure in order to result in effective chemical/mechanical removal of upper portions of the layer **22** In **FIG. 3**" (column 5, lines 35-42). The above reads on,

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A method of fabricating a semiconductor wafer, comprising:

(a) polishing a semiconductor wafer with a polishing pad.

Farkas also teaches, "The slurry **24**, illustrated in **FIG. 3**, contains . . . an abrasive slurry/agent, a solvent, . . ." (column 5, lines 61-64). "Typical solvents used in the slurry **24** of **FIG. 2** is one or more of deionized water (H<sub>2</sub>O) or an alcohol" (same as a nonaqueous solvent), (column 6, lines 10-12). The aforementioned further reads on,

(b) disposing a volume of a non aqueous solvent onto said semiconductor wafer, **in claim 1**;

(a) includes disposing a volume of an aqueous slurry containing an abrasive material onto said semiconductor wafer, **in claim 2**;

said polishing pad is in contact with said semiconductor wafer when said nonaqueous solvent is disposed onto said semiconductor wafer, **in claim 3**; and

A method of fabricating a semiconductor wafer, comprising:

(a) subjecting a front side of said semiconductor wafer to chemical mechanical polishing; and

(b) disposing a volume of a nonaqueous solvent onto said front side of said semiconductor wafer, **in claim 12**.

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Farkas (US '730) as applied to claim 1 above, and further in view of Kobayashi (US. 5,9865,045).

Farkas differs in failing to teach (c) mixing said aqueous slurry and said nonaqueous solvent in a mixing unit so as to increase an aqueous slurry/nonaqueous solvent mixture prior to being disposed onto said semiconductor wafer.

Kobayashi teaches, "A chemical-mechanical polisher **(10)** includes a mixer section **(12)** that mixes components of a polishing fluid prior to introducing the polishing fluid onto a polishing section **(13)** of the polisher **(10)**" (Abstract). "For example, container **111** may include concentrated polishing fluid, and container **112** includes a diluent, such as water, an alcohol, a glycol, and the like" (column 3, lines 17-19). "A polishing fluid may include only liquids or include at least one liquid and particles" (column 5, lines 63-64), which provides evidence that Kobayashi's polishing fluid is the same as applicants aqueous slurry and further reads on, mixing said aqueous slurry and said nonaqueous solvent in a mixing unit. Since Kobayashi mixes an aqueous slurry and nonaqueous solvent like that of the claimed invention, then using Kobayashi's method of mixing an aqueous slurry and nonaqueous solvent in the same manner as that of the claimed invention would result to increase an aqueous slurry/nonaqueous solvent mixture prior to being disposed onto said semiconductor wafer.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Farkas' slurry by

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using Kobayashi's method of mixing an aqueous slurry and nonaqueous solvent for the purpose of having a higher polishing rate than is achieved with a batch mixing system (Kobayashi, column 6, lines 16-18).

6. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farkas (US '730) as applied to claim 1 above, and further in view of Kimura (US. 5,869,392).

Farkas differs in failing to teach (c) increasing the weight % of said nonaqueous solvent in said aqueous slurry/aqueous solvent mixture during said polishing of said semiconductor wafer, **in claim 5**; and said weight % of said nonaqueous solvent in said aqueous slurry/aqueous is increased until said aqueous slurry/nonaqueous solvent mixture is substantially free of said aqueous slurry, **in claim 6**.

Kimura teaches in the CMP process, chemical polishing variables include the kind, pH, and composition of solvent; and mechanical polishing variables include the kind and concentration of slurry, the kind of polishing cloth, the pressure applied to abrasive, and the rotational speed of a carrier (wafer) (column 4, lines 11-16), which provides evidence that the concentration of the solvent is a so-called "result effective variable."

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Farkas by using Kimura's solvent composition, which serves as evidence that the composition of a solvent serves as a so-called "result effective variable" since it has been held that the

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discovery of an optimum value for result effective variables is within the purview of routine experimentation by the person of ordinary skill in the art. In re Boesch, 617 F.2d 272,276,205 USPQ 215, 219 (CCPA 1980).

7. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Farkas (US '730) as applied to claim 1 above, and further in view of Merchant et al. (US 6,436,830 B1).

Farkas differs in failing to teach said nonaqueous solvent includes an ammine.

Merchant teaches, "The CMP slurry **10** includes a first emulsion **11** having a continuous aqueous phase (AQ<sub>E</sub>) **12** and a second emulsion **13**. . . . The first emulsion **11** includes abrasive particles **18** . . . The second emulsion **13** preferably comprises an organic phase (ORG) **14** and a dispersed aqueous phase (AQ<sub>I</sub>) **16** for capturing metal particles polished from the semiconductor wafer **20**" (column 3, lines 49-60). "The organic phase **14** may comprise alcohol or iso-alcohol and preferably includes at least one complexing agent such as, from example, . . . bi-pyridine (which is an example of a nonaqueous ammine) . . ." (column 4, lines 12-19).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Farkas' polishing composition by including a nonaqueous solvent such as an ammine that is taught by Merchant for the purpose of capturing metal particles polished from the semiconductor wafer (Merchant, column 3, lines 56-60).

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8. Claims 8 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farkas (US '730) as applied to claims 1 and 12 respectively above, and further in view of Zhou et al. (US 5,780,358).

Farkas differs in failing to teach said nonaqueous solvent includes dimethylsulfoxide (DMSO).

Zhou teaches "Preferably, the non-aqueous coordinating solvent with the Chemical-Mechanical Polishing (CMP) slurry composition of the present invention is chosen from the group of . . . (DMSO)" (column 8, lines 1-6). "In addition to the non-aqueous coordinating solvent, . . . the abrasive powder, various other components may optionally be included within the Chemical-Mechanical Polishing (CMP) slurry composition of the present invention. These components include but are not limited to . . . aqueous and non-aqueous co-solvents . . . and the like as are know in the art to impart other desirable properties to the Chemical-Mechanical Polish (CMP) slurry composition of the present invention" (column 8, lines 40-49).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Farkas' polishing slurry by including DMSO to a polishing slurry, as taught by Zhou for the purpose of assisting in rapid dissolution of copper metal under mild conditions (column 7, lines 51-55).



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### Claim Objections

9. Claims 9, 10, 11, 13, 15-17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 703-306-9074. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 703-305-2667. The fax phone numbers for the organization where this application or proceeding is assigned are 703-972-9310 for regular communications and 703-972-9311 for After Final communications.

*Lynette T. Umez-Eronini*

ltue

August 21, 2003